NOAA's GOES R - Next Generation Satellite

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***ABSTRACT* -** NOAA's next generation Geostationary Operational Environmental Satellite (GOES) beginning with GOES R is the follow-on to the GOES N-P series. GOES R is being developed for launch in the 2012 time frame to meet new requirements validated through a rigorous screening and verification process. It presents an opportunity to explore new instruments, satellite designs, and system architectures. NOAA's National Environmental Satellite, Data and Information Service (NESDIS) will explore if an alternative distributed architecture might be more cost-effective than continuing the current philosophy of combining all instruments onto one big spacecraft.

GOES R improvements in environmental sensing instruments include an Advanced Baseline Imager (ABI); a Hyperspectral Environmental Suite (HES), capable of providing soundings and imagery; an Enhanced Solar X-ray Imager (ESXI); a Space Environment Monitor (SEM); and a Lightning Mapper (LM). NOAA is also investigating other possible operational instruments, such as a coronagraph solar Imager, and microwave sounder. NOAA will analyze the different architectures (distributed vs. consolidated), instruments (ABI, HES, SEM, SXI, LM) and orbits (GEO vs. MEO) to determine the optimal constellation coverage and communication configuration.

ABI and HES sensors will support CONUS Coastal Waters (CW) and estuaries with timely imaging and sounding. The CW zone is defined as the ocean waters 400 miles adjacent to CONUS as well as all estuaries. HES will support coastal water ocean color and ocean optical properties at a resolution of 300 meters. ABI will support long wave IR measurements of sea surface temperatures (SST).

Currently, ABI formulation studies are underway with three contractors. Overall systems concepts are under study following a Request for Information (RFI) from contract sources and meetings with industry regarding the overall approach. In the summer of 2003, procurement activities for concept studies for the HES were initiated with several contractors. Similar activities will be inaugurated for other instruments, ground systems and spacecraft concepts. This paper provides the latest status of these activities as well as an update on its Concept of Operations (CONOPS).

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I. INTRODUCTION

The mission of NOAA NESDIS is: *"to provide and ensure timely access to global environmental data and information services from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life."* (NOAA NESDIS Mission Statement, 2000) The GOES R CONOPS document is designed to give an overall picture of the "who, what, where, when and why" for the next generation of geostationary satellites. This document is a system-level piece of the NESDIS 2012 – 2020 CONOPS (Figure 1). The CONOPS and system architecture are conceptual documents that provide a discussion on the missions being addressed, a system description (characteristics and capabilities), and a breakdown of operational criteria to include:

- user needs
- launch, sustainment, and on-orbit operations of space-based platforms
- ground system operations
- data ingest
- product generation, analysis and dissemination
- archive, access, and scientific stewardship of environmental data

The GOES R CONOPS uses the same structure as the NESDIS 2012 – 2020 CONOPS to highlight linkages between segment level concepts and specific concepts for future geostationary operations.

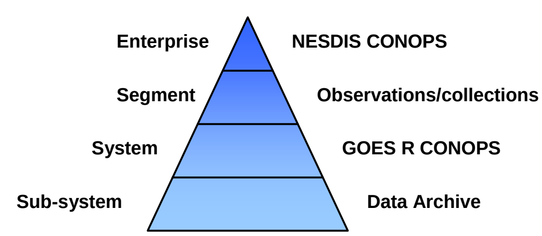

Figure 1 Enterprise Hierarchy

A. GOES R Concept

The GOES R system will build on the NESDIS data collection services core competencies (acquisition, archiving and assessment), expanding capabilities and functions as necessary to meet user needs. The NESDIS Strategic Plan is the road map guiding this effort, ensuring cohesiveness with other NOAA and NESDIS initiatives, as well as the need to provide for system integrity and security to ensure homeland security needs are met.

As NESDIS moves in to the future, it is also exploring new partnerships with industry, other U S and foreign agencies with the GOES R program.

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II. OPERATIONAL NEED

The GOES R system goals are

- Maintain continuous, reliable operational environmental, and storm warning systems to protect life and property
- Monitor the earth's surface and space environmental and climate conditions
- Introduce improved atmospheric and oceanic observations and data dissemination capabilities (increased spatial, temporal and spectral resolution)
- Develop and provide new and improved applications and products for a wide range of federal agencies, state and local governments, and private users

The following sections describe the operational needs and the requirements process, including the known shortcomings of the current GOES system and emerging user requirements.

A. Shortcomings of the Existing GOES Systems

In the following sections the shortcomings of the current GOES I-M and GOES N series systems are identified as a basis for why the GOES R system development is necessary. The shortcomings, covering both the space and ground segment, include: mission continuity; data losses; simultaneous hemispheric, synoptic, and mesoscale imaging; and data latency/timeliness.

1. Mission Continuity

Replacement satellites are required to sustain US geostationary capabilities beyond 2012. Expected mean mission duration for the GOES I-M and GOES N series will support full mission availability through ~2018. Currently available instrument capabilities are inadequate to meet many emerging requirements, necessitating the development of new technologies.

2. Data Losses

Data losses occur for several hours each day during the weeks around each equinox (eclipse). This is a result of the viewing geometry of the current geostationary satellites, which allows sunlight impingement on the optical path of the sensing instruments. This direct sunlight may cause a degradation of the radiometric response accuracy and potential permanent damage to the Earth-viewing detectors. To avoid such damage, data is not sensed nor provided during these periods – termed the "keep out zones." The combined impact on the current GOES I-M and GOES N series is a 3 to 4 hour loss of data for 10 to 12 days before and after each eclipse (around the spring and fall equinox).

During these keep out zones and periods, there is significant loss of data for National Weather Service (NWS), which impacts critical forecasting and modeling operations. The spring eclipse and keep-out zone period coincides with the beginning of the tornado season while the fall eclipse and keep-out zone period coincides with the peak of the Atlantic Hurricane season (see figures 2 and 3).

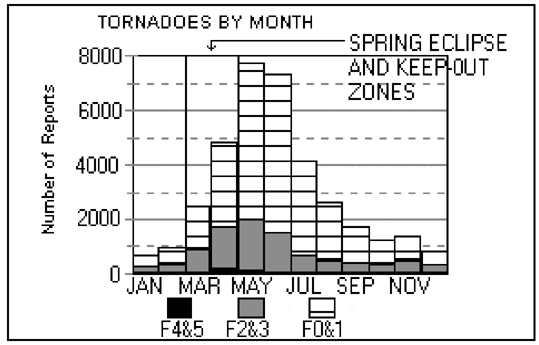

Figure 2 Spring Eclipse and keep-out-zones superimposed on the tornado season

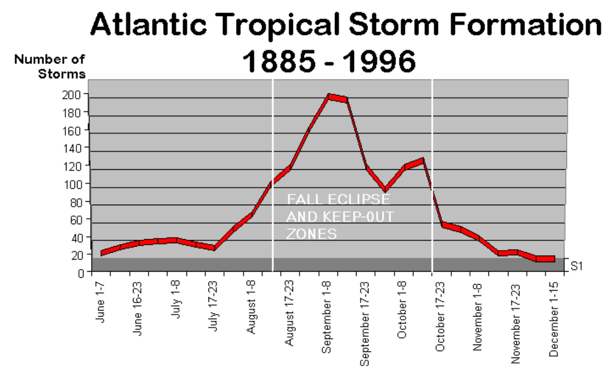

Figure 3 Fall Eclipse and keep-out-zones superimposed on the hurricane season.

Periodic spacecraft maneuvers are required to adjust the drift and orbit of the geostationary satellites and to counteract the gravitational forces from the sun and the moon. The time needed for the current GOES I-M satellites and the GOES N series to return to normal operations after such maneuvers may be up to 9 hours. This excessive delay is unacceptable for forecast and modeling operations that require and depend upon timely satellite data input.

3. Simultaneous Hemispheric, Synoptic, and Mesoscale Imaging

The current GOES I-M and GOES-N series cannot provide simultaneous Hemispheric (Full Disk), synoptic (CONUS Regional) and Mesoscale (Rapid-Scan) imaging. They are unable to provide Southern Hemispheric images during Rapid-Scan operations (invoked to support severe weather outbreaks) and cannot meet the temporal requirements for Full Disk and CONUS updates. Imaging and derived high-density wind products below the equator are also required during Mesoscale imaging. The current lack of wind measurement degrades performance of global forecast models by as much as ten percent.

4. Data Latency (Timeliness)

Product delivery must be done in near real-time to capture rapidly changing, relatively short-term events, (e.g., severe weather, thunderstorms, and flash floods). The usefulness (forecast value) of the current GOES imagery is greatly diminished if the images are not available for analysis by the forecaster before the start of the next image, i.e. in near real-time. Data latency sometimes exceeds two hours from the time measured until available for use at national forecasting centers. Reducing data latency will allow more timely and accurate warnings and forecasts.

B. Improvements of GOES R

The GOES R system is planned to operate for a period of at least 14 years, providing a remote sensing capability to acquire and disseminate regional environmental imagery and specialized meteorological, climatic, terrestrial, oceanographic, solar-geophysical and other data to central processing centers and distributed direct users. This section provides a description of the proposed system. However, the GOES R architectural elements identified in the following subsections may vary depending on the final system architecture concepts. Regardless of final system design, the following functional elements must be addressed:

- Capacity. Address how the system will optimize assigned resources, support mission growth, handle large data volume, and meet contingency requirements.
- Command, Control, and Communications (C^3). Address how the system will integrate into the existing command and control structure, and how it will evolve with the C^3 challenges of the future.
- Operability and Flexibility. Address how the system will maintain continuity of operations to assure mission accomplishment. Address to what extent the system will be self-contained.
- Survivability and Endurability. Address the level of disaster/conflict the system will survive/endure to assure mission accomplishment.
- Standardization and Interoperability. Address how the system will be standardized and interoperate with existing infrastructure, both within and outside of NESDIS. Identify procedural and technical interface standards to be incorporated into the system or operational design to ensure the required degree of interoperability between the system and operation. A system will be designed to conduct normalized operations and maintenance consistent with the mission and responsibilities delegated to it. Areas to address may include how standard commercial-off-the-shelf (COTS) hardware and software may be utilized for mission execution and for enhancing commonality of replacement parts with other like units. Address considerations for government-off-the-shelf and non-developmental item (NDI) hardware and software. This commonality of hardware/software will enable systems with compatible and/or similar missions to share the same resources.
- Reliability, Maintainability, and Sustainability. Address any reliability/maintainability issues that may include single point failures, common maintenance support, and operation & maintenance (O&M) or life cycle costs.
- Manpower, Basing, and Program Management Structure. Address basing and manning constraints and identify expected program management structure. Areas to consider may include automation to minimize manpower requirements and cooperation with other government agencies to take advantage of economies of scale. Facility considerations must also be addressed.
- Product Development, Data and Product Distribution, and Archive and Access of saved data, products and user interfaces.

From an architectural perspective, the GOES R system will consists of six segments: 1) Space; 2) Launch Support; 3) Command, Control, and Communications (C^3); 4) Product Generation and Distribution (PG&D); 5) Archive and Access; and 6) User Interface. While the GOES R Space, Launch Support, and C3 Segments will be new assets and unique to GOES R, the PG&D, Archive and User Interface Segments will build on existing operational segments that will be modified to support the GOES-R series. Applied research will interface with all of the above segments. Figure 4 provides a GOES R Segment overview

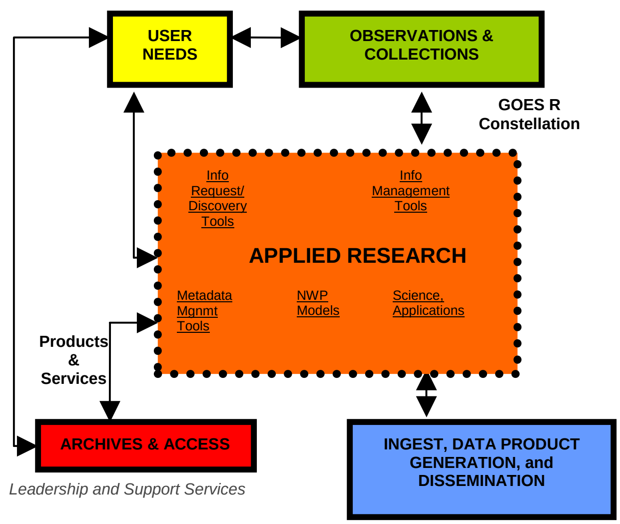

Figure 4 GOES R Segment Overview

III. SYSTEM OVERVIEW

A. Distributed Architecture

One of the possible differences with this next generation satellite will be the distributed architecture concept. GOES R could benefit from a new more flexible distributed system

architecture. Distributed architecture differs from the current consolidated architecture, as sensors, communications and services are deployed across numerous satellites. Distributed architecture would enable NOAA to realize the benefits of prolonged satellite life. Satellites equipped with one as opposed to two frontline sensors (ABI and HES) would have longer mean mission durations (MMDs) because fewer components allows for greater reliability. In addition, separating components (sensors, communications, and services) increases technology infusion flexibility and improves sparing strategy. In the event of a sensor failure or an infusion opportunity, NOAA would replace only those components requiring replacement.

The optimal GOES R architecture will be evaluated by a twelve-month, industry led, architecture study. Options include varied communications alternatives. Figure 5 depicts an example of the GOES R distributed architectures. The inclusion of Mid Earth Orbit (MEO) for communications and services is also a consideration and would enable GOES R to support other missions and provides transition to NOAA's concept of a Global Observing System.

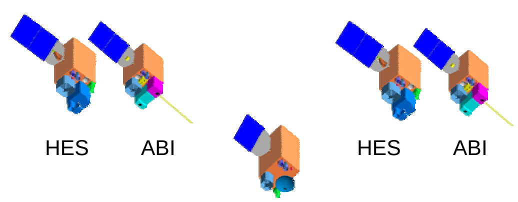

Figure 5 Distributed Architecture example with separate comms

1. Space Segment

The Space Segment will consist of the spacecraft and its meteorological, oceanographic, terrestrial, space, solar, and environmental monitoring sensors, in addition to other systems for surface data collection/location/distribution and search and rescue. All sensed data will be transmitted at its optimum resolution to the Command and Data Acquisition (CDA) sites, delivered to the NESDIS Product Generation and Distribution (PG&D) Segment and retransmitted for direct readout users, under the control of the C^3 Segment. The CDA segment will geo-locate and calibrate the raw data to Level 1B. Ancillary data and other satellite data will be merged to create Level 2 data products. The PG&D will distribute level 1B, Level 2 and higher data to both users and archive facilities as required. Real-time data will also be continuously rebroadcast to direct readout users within the satellite field of view. In summary, the Space Segment could support the following sensors, equipment, and functions:

- Advanced Baseline Imager (ABI)
- HyperSpectral Environmental Suite (HES)
    - Sounder and Imager
- Space Environment Monitoring (SEM)
- Enhanced Solar X Ray Imager (ESXI)
- Lightning Mapper (LM)
- Instruments of Opportunity (IOO)
    - Coronagraph Solar Imager
    - Microwave Radiometer
- Services
    - Data Collection System (DCS)
    - GOES Re Broadcast (GRB)
    - Search and Rescue (SAR)
    - Low Rate Information Transmission (LRIT)
    - Emergency Manager's Weather Information Network (EMWIN)

Other federal, state and local agencies, academia, and industry, on a worldwide basis, will be able to access GOES R series real-time broadcast data. Broadcast capabilities of the GOES R series are currently under study. The issue of how to perpetuate the current policy of global broadcasting of all processed data has not been resolved. Ending the global broadcast from GOES would reduce the RF requirements and alter the satellite design, but would severely impact low end users. Commercial communications satellites and the use of landlines are also being considered.

C. Sensor Improvements

1. Advanced Baseline Imager (ABI)

The Advanced Baseline Imager is a new state of the art, 16-channel imager covering 2 visible bands (0.47 µm & 0.64 µm) and 14 IR bands (0.86 µm to 13.3 µm). Spatial resolution is band dependent, 0.5 km at nadir for broadband visible, 1.0 km for near IR and 2.0 km for IR. ABI will provide three imaging sectors; Full Disk (FD), CONUS, and Mesoscale. Full Disk includes the full Earth view from space. The CONUS sector covers a 5000 km x 3000 km area and Mesoscale covers a 1000 x 1000 km square at nadir. The larger ABI field of view will provide additional Earth coverage as compared to current GOES. Figures 6 and 7 compare the coverage between the current (GOES I-P) and future (GOES R) constellations. The inner ellipses on Figure 7 represent HES coverage; the outer ellipses represent ABI coverage.

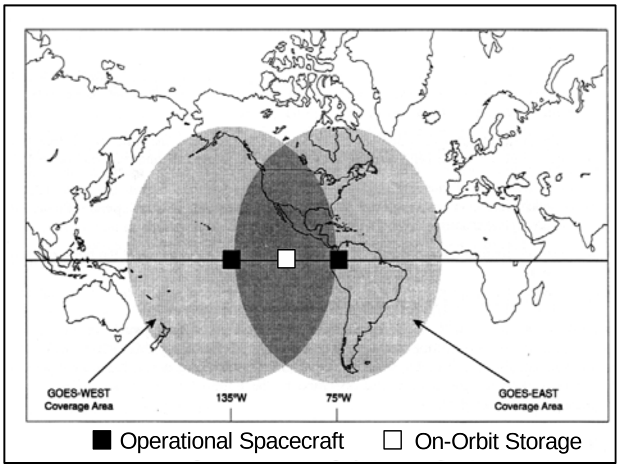

Figure 6 Current GOES (GOES I-P) coverage

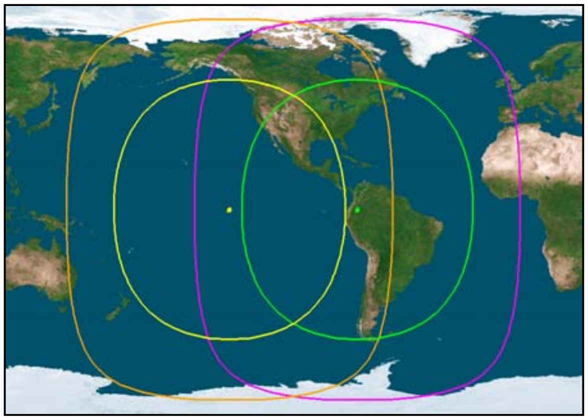

Figure 7 Increased GOES R coverage

ABI has two imaging modes; Mode 3 and Mode 4. Mode 3 imaging can provide 1 Full Disk Image, 3 CONUS and 30 Mesoscale images every 15 minutes. Mode 4 can provide 30 Mesoscale images every 15 minutes as well as a Full Disk every 5 minutes. Figure 8 compares GOES R Mode 4 FD coverage (left) against current GOES (right). Current GOES (I-P) provides a Full Disk every 30 minutes, thereby providing $1/6^{th}$ the GOES R coverage in five minutes.

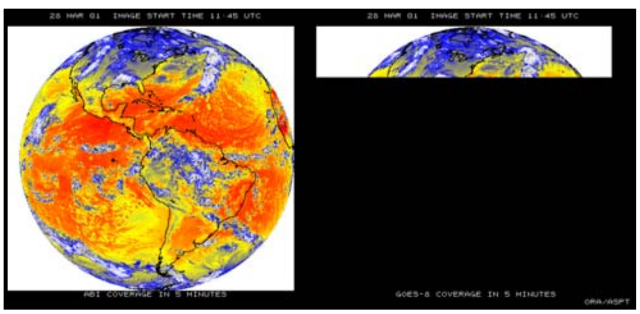

Figure 8 GOES R and current GOES 5 minute coverage

2. Hyperspectral Enviromental Suite (HES)

The HES is a multi channel imager and sounder instrument suite with three threshold tasks. HES will provide high-resolution Hemispheric Disk Soundings (DS) and Severe Weather Mesoscale (SW/M) soundings and Coastal Waters (CW) imaging.

HES DS provides 10 km IR resolution from 3.7 µm to 15.4 µm with a one-hour refresh rate of the full disk, 62° local zenith angle. Visible resolution will be 1 km from a single broadband channel (0.4 µm to 1.0 µm). SW/M will cover a 1000 x 1000 km square at 4 km resolution for IR and 1 km for visible from a single broadband channel for cloud detection. DS and SW/M may utilize the same IR and Visible focal planes. The total number of channels is still TBD but will exceed 1000.

HES CW task will provide at least 14 channels coverage from 0.4 µm to 1.0 µm, with a 300 m visible resolution and a 1-hour refresh rate. CW has a goal resolution of 2 km for IR imagery. Coastal Waters are defined as the 400 km zone adjacent to CONUS.

3. Enhanced Solar X Ray Imager (ESXI)

The ESXI is a broadband imager capable of operating in the soft X-ray to Extreme Ultra Violet (EUV) wavelength range. It provides full-disk solar images at high cadence around the clock, except for brief periods during orbital eclipse seasons. Available combinations of exposures and filters allows the coverage of the entire dynamic range of solar X-ray features, from coronal holes to X-class flares, as well as the estimate of temperature and emission measure. The operational goals are to: locate coronal holes for geomagnetic storm forecasts, detect and locate flares for forecasts of solar energetic particle (SEP) events related to flares, monitor changes in the corona that indicate coronal mass ejections (CMEs), detect active regions beyond east limb for forecasts, and analyze active region complexity for flare forecasts.

4. Space Environmental Monitor (SEM)

The SEM suite monitors the near-Earth particle and electromagnetic environment, as well as the solar EUV and X-ray output. Its instruments include a three-axis vector magnetometer, energetic particle sensors (EPS), an extreme ultraviolet sensor (EUVS), and a solar X-ray sensor (XRS). The entire set of instruments is designed to provide real-time measurement of solar activity, the charged particle environment, and the Earth's magnetic field. In addition, the Solar X-ray imager (SXI) and the coronagraph provide continuous images of the solar disk in X-ray and white light images of the solar corona, respectively. All SEM instruments shall be capable of operating and transmitting data during eclipses, and each instrument shall be capable of independent operation.

5. Lightning Mapper (LM)

The LM shall continuously map the intensity, frequency and location of lightning discharges over both hemispheres and CONUS. A GEO based LM with high spatial resolution and detection efficiency will be an invaluable tool in severe storms forecasting. LM can detect storm formulation and determine maturity/severity over both land and oceans. Threshold hemisphere horizontal resolution shall be 8 km (with a objective of 4 km for CONUS). The mapper will image 500 frames per second and capable of detecting in excess of 50 lightning strikes per second. The mapping accuracy should be 1 km (goal: 100 m). The measurements would be disseminated in real time (within 1 min) and could thus be related on a continuous basis to other observable data, such as radar returns, cloud images, and other meteorological variables.

D. Applications

The increased resolution of GOES R (spatial, spectral and temporal) should benefit ocean observations and ocean sciences. Hyperspectal sounding and CW imaging will improve the detection of atmospheric inversions, cloud properties, land/sea surface properties and moisture gradients. Figure 9 illustrates the spatial improvements in hurricane coverage expected with GOES R. Table 1 summarizes GOES R observational requirements.

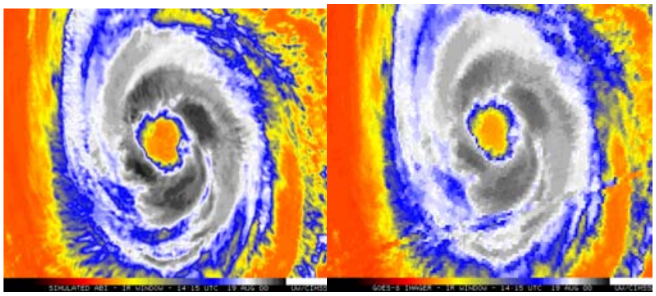

Fig 9 - Hurricane Coverage From GOES R vs. GOES

ABI	HES
Hurricane Intensity	Ocean Color
Flood/Standing Water	Ocean Optical Properties
Ice Cover	Ocean Turbidity
Ocean Currents	Surface Emissivity
Sea and Lake Ice Conditions	Sea and Lake Ice Conditions
Sea Surface Temperatures	Mositure Flux
All Weather Day Night Imagery	Radiances
Cloud Top Height	Total Precipitable Water
Snow Cover/Snow Depth	Cloud Top Height
Absorbed Shortwave Radiation	Ozone Layers
Aerosol Detection	Microburst Winds
Aerosol Particle Size	SO_2 Concentration
Cloud/Moisture Imagery	CO & CO_2 Concentrations
Suspended Matter	Atmo Vertical Moisture
Volcanic Ash	Atmo Vertical Temperature
Derived Motion Winds	Cloud Base Height

Table 1 GOES R Observational Requirements

ABI and HES sensors will support timely marine hyperspectral imaging and sounding of the following areas: *CONUS*; *Hemispheric; Mesoscale*; and *Offshore/CONUS*. CONUS is defined as the contiguous US., approximately 3000 km N/S by 5000 E/W. Hemispheric coverage extends from 0 degrees meridian to 150 degrees East. Normal Mesoscale covers 1000 x 1000 km, while Mesoscale over ocean covers 1000 km x 400 km. The Coastal Water (CW) zone is defined as those waters within 400 km adjacent to CONUS. Open Oceans (OO) lies beyond the Economic Exclusion Zone (200 nautical miles) and Offshore/CONUS coastal and estuary waters covers from the shore line up to the EEZ.

1. GOES R Ocean Requirements

GOES will satisfy the following ocean requirements; currents, ocean color, optical properties, ice age and concentration, as well as sea surface temperatures

a) Ocean Currents

GOES R will measure ocean currents for Mesoscale, Hemispheric and CONUS/Offshore. Resolution will be 2 km with 0.75 km mapping uncertainty over the range of 0-1.8 km/hour. Date Latency will be approximately 60 minutes with refresh rates between 3 – 6 hours. Mesocale ocean covers an area of 1000 km x 400 km while Hemisphere covers from to 0 to 150E.

b) Ocean Color

GOES R will measure Ocean Color properties (Turbidity/Chlorophyll/Reflectance) in the coastal region (inside the EEZ). Resolution will be 300 m with 300 m mapping uncertainty over the range of 0-1.8 km/hour. Data Latency will be 1- 3 hours hours with a refresh rate of 3 hours.

c) Optical Properties

GOES R will measure Ocean Optical Properties **(**Particulate absorption, Backscatter, fluorescence**)** in the coastal region (inside the EEZ). Resolution will be 300 m with 300 m mapping uncertainty over the range of 0-1.8 km/hour. Data Latency will be 1- 3 hours hours with refresh rate of 24 hours.

d) Sea & Lake Ice Age

GOES R will contribute to Sea & Lake Ice Age determination in Hemispheric and CONUS. Resolution will be 2 km with 0.75 km mapping uncertainty. Date Latency will be approximately 3 hours with a refresh rate of 3 hours.

e) Sea & Lake Ice Concentration

GOES R will contribute to Sea & Lake Ice Concentration determination in Hemispheric and CONUS. Resolution will be between 10 - 25 km, with 10 – 25 km mapping uncertainty. Date Latency will be approximately 3 hours with a refresh rate of 3 hours.

f) Sea & Lake Ice Surface Temp

GOES R will contribute to Sea & Lake Ice Surface Temperature determination in Hemisphere and CONUS. Resolution will be 2 km with a 1 km mapping uncertainty. Date Latency will be approximately 3 hours with a refresh rate of 3 hours.

g) Sea Surface Temp

GOES R will contribute to Sea Surface Temperature determination in Coastal Zone. Resolution will be 300 m with a mapping accuracy less than 300 m. Date Latency will be approximately 3 hours with a refresh rate of 1- 3 hours.

GOES R will contribute to Sea Surface Temperature determination in Hemispheric, Mesoscale and CONUS. Resolution will be 2 km with a 0.75 km mapping uncertainty. Date Latency will be approximately 15 minutes with a refresh rate of 1 hour.

IV. SUMMARY

The GOES R system will transition from and begin replacing the GOES N series beginning circa 2012. Based on new architecture concepts and system designs, the GOES R series will continue to meet and exceed GOES mission goals.

As part of the process to ensure that these goals are met, NOAA/NESDIS is developing the GOES R CONOPS to follow

the lines of an Enterprise CONOPS. This work is a conceptual living document that provides linkage to the system-element of the 2012 – 2020 NESDIS CONOPS; to the NOAA and NOAA Line Office Strategic Goals; and to the NOAA User community's requirements.

Sensor improvements will enable more timely ocean and atmospheric forecasts. Additional hyperspectral bands and increased spatial resolution will enable improved tracking and discrimination of surface temperatures, precipitation and cloud cover. The increase in GOES R latency will improve forecasts and climate/hydrology monitoring. The inclusion of a GEO based Lightning Mapper will provide continuous lightning detection over land and water. Storm severity and maturity knowledge will be improved by the ability to track lightning intensity, frequency and location from space.

GOES R HES will measure ocean colors and ocean optical properties. HES will provide high-resolution (300 m) coverage of the CW region. ABI will detect cloud cover, storms, and hurricanes. ABI will measure currents and sea surface temperatures. The synergy of ABI, HES and other NOAA sensors will increase overall understanding of ocean phenomena.

For additional information, please visit NOAA's GOES R webpage at http://www.osd.noaa.gov/goes_R/index.htm. GOES R requirements are listed in the Performance Requirement Document listed at ftp://ftp.osd.noaa.gov/Goes-R/PRD

A. References:

Consolidated Observations Requirements List (CORL), Version 0.1, June 2002

Mission Requirements Document, -1A Draft, (MRD1), NOAA GOES Program Office, July 2003

NESDIS, A Strategic Approach for the New Millennium, 2001

NESDIS Mission Observations Requirements List (MORL), Version 0.1, June 2002

NOAA NESDIS Satellite Data Processing Center, Comprehensive Large Array-data Steward-ship System (CLASS) Archive and Access Requirements, July 20, 2001

Program Requirement Document – 1 Final Draft, NOAA, (PRD1), June 2003